

Dialysis and Mortality: Does It Matter Where You Live?

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A 70-year-old man with diabetic nephropathy and a history of multiple admissions for congestive heart failure is approaching the need for renal replacement therapy. He is struggling with his decision regarding the optimal dialysis modality. He lives alone in rural Washington, 60 miles from the nearest dialysis unit. He is a man of modest means and cannot afford the transportation costs associated with thrice weekly in-center hemodialysis. Given his less than optimal prior compliance with his complex medical regimen, he is a risky candidate for peritoneal or home hemodialysis. Due to transportation issues, he decides that peritoneal dialysis is his only viable option. Does geography impact on patient survival? Clinicians usually do not consider a patient's residence when making clinical decisions, but epidemiologic evidence has shown that patient characteristics, health services, and patient outcomes vary significantly according to rural versus urban residence. These geographic differences also exist within urban areas depending on residential characteristics. Rural America represents approximately 20% of the US population and is comprised of diverse cultures, landscapes, and economic and social characteristics. In 2005 the Institute of Medicine report, *Quality through Collaboration: The Future of Rural Health Care*, was released with the goal of providing an independent assessment of health and health care in rural America and formulating an action plan for quality-focused rural community health systems (1). The report highlighted a number of important issues in rural America including reduced access to quality health services, poor access to quality emergency services, and adverse patient characteristics such as higher rates of obesity, suicide, alcohol and tobacco use, poverty, and inferior treatment for acute myocardial infarction. These factors are of importance to rural patients with CKD and could represent major barriers to quality renal and general medical care.

In this issue of the *CJASN*, Maripuri *et al.* (2) present a retrospective cohort study showing that rural residence is associated with higher mortality in those rural patients receiving peritoneal dialysis. This study is a nice extension to our previous work, which had not stratified survival results by dialysis modality and therefore had not shown an increase in mortality in rural patients on peritoneal dialysis. Our study did hint at a problem by showing that facilities in rural

areas were less likely to offer peritoneal dialysis than those units in urban areas (3). Other studies in the United States and Canada have also shown an association between poor patient outcomes and rural residence (4,5).

When reading this study, it is important to note the difficulty in comparing survival between peritoneal and hemodialysis patients. Not only do the therapies differ tremendously, but the patients themselves are quite different, with peritoneal dialysis patients tending to be younger with less comorbidities. The findings of numerous studies comparing survival between the modalities have not been consistent (6). In an attempt to better match patients by important baseline characteristics, a recent study compared survival between the modalities by using a matched-pair cohort with the matching based on propensity of initial peritoneal dialysis (7). The study found that survival was modestly longer for patients initiating renal replacement therapy with peritoneal dialysis compared with matched hemodialysis patients. However, similar to other studies, they found this modality survival effect is modified by age and the presence of diabetes. In general, peritoneal dialysis patients >65 years of age and those with diabetes have a higher risk of death than those on hemodialysis. Adding to the complexity of comparing dialysis modalities, the rural population tends to be older with more comorbidities, and this is true in this study by Maripuri *et al.*, in which the rural and micropolitan population is older and all medical comorbid conditions with the exception for alcohol and drug use are more prevalent in the non-urban population. Therefore, despite controlling for the baseline characteristics, the results of the study could be confounded by the unmeasured differences and/or the differences in severity of the comorbid conditions in the rural population. Despite this possibility, the results of the study are important and should not be ignored by clinicians. The results of this study are consistent with other studies and call attention to the fact that many rural patients are high-risk candidates for peritoneal dialysis on the basis of age and comorbid conditions.

It is also important to note that there is no accepted definition of rural and that the level of isolation varies dramatically among the rural population in the United States. As clinicians, we worry about patients who live

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in remote areas where access to care is problematic for both the patient and providers. The concept of frontier rural tries to capture the smallest and most geographically isolated communities in the United States. Frontier rural areas are defined by several features including population density (persons per square mile), distance in miles to services/market, and time in minutes to services/market (8). The Northwest Renal

Network represents Alaska, Idaho, Montana, Oregon, and Washington, and these states are among the top-ranking frontier states as measured by percentage of frontier lands. Therefore, it is not surprising that the percent of patients on peritoneal dialysis in Alaska, Idaho, and Montana is 25%, 19%, and 17%, respectively (US average = 8%) (9). By comparison, Network 8 serves a large rural but non-frontier population, and the percent of patients on peritoneal dialysis in Alabama, Mississippi, and Tennessee is 9.9%, 9.7%, and 10.1%, respectively (10). Figure 1 shows the distributions of dialysis units and population centers in these states, and the potential geographic barriers are obvious in large frontier states like Alaska along with the disincentive to choose in-center hemodialysis. This study by Maripuri *et al.* was able to show higher long-term mortality risk for those peritoneal dialysis patients residing farther from a dialysis unit, a finding that has been reported in other countries (2,5).

A few of the potential explanations for poor outcomes in rural peritoneal dialysis patients include inadequate nonrenal medical services, poor peritoneal dialysis support, patient reluctance to change modalities even if failing peritoneal dialysis, insufficient predialysis education, poor peritoneal dialysis catheter management, and poor patient selection and training. As previously mentioned, rural areas have less than optimal general medical and emergency services; nonetheless, these deficiencies should affect both hemodialysis and peritoneal dialysis patients equally. Although prolonged travel times are burdensome for hemodialysis patients, they are seen thrice weekly by the dialysis staff, which is likely beneficial in the rural population with a larger burden of comorbid conditions. In a provocative study of Canadians treated by peritoneal dialysis in remote locations, Tonelli *et al.* (5) found that patients in remote areas were more likely to switch from hemodialysis to peritoneal dialysis and were less likely to suffer peritoneal dialysis technique failure leading to conversion from peritoneal dialysis to hemodialysis. One plausible explanation for this finding is that patients choose peritoneal dialysis or remain on peritoneal dialysis despite not being ideal candidates, and some may remain on peritoneal dialysis despite no longer being able to achieve adequacy guidelines. However, a higher risk of technique failure in rural patients was not found in a US study of Baxter patients (4). The possible explanations for the higher mortality risk in rural peritoneal dialysis patients should be explored further in future studies.

Despite the concerns raised by this paper, the clinical response should not be to discourage rural patients from attempting peritoneal dialysis. Instead, creative and innovative solutions should be implemented to support those patients who remain viable candidates in rural areas. For example, other countries have started to support rural patients by developing peritoneal dialysis specific telemedicine technology, and others have developed peritoneal dialysis satellite units that include physicians able to place and manage peritoneal dialysis catheters (11,12). For patients who are failing peritoneal dialysis, home hemodialysis could also be a viable option. Kidney transplantation is the best solution for appropriate rural candidates, and it was reassuring that this study by Maripuri *et al.* confirmed that rural patients had a similar or higher likelihood of kidney transplantation as urban patients (2,13). In addition to the nephrology team, management of these rural patients

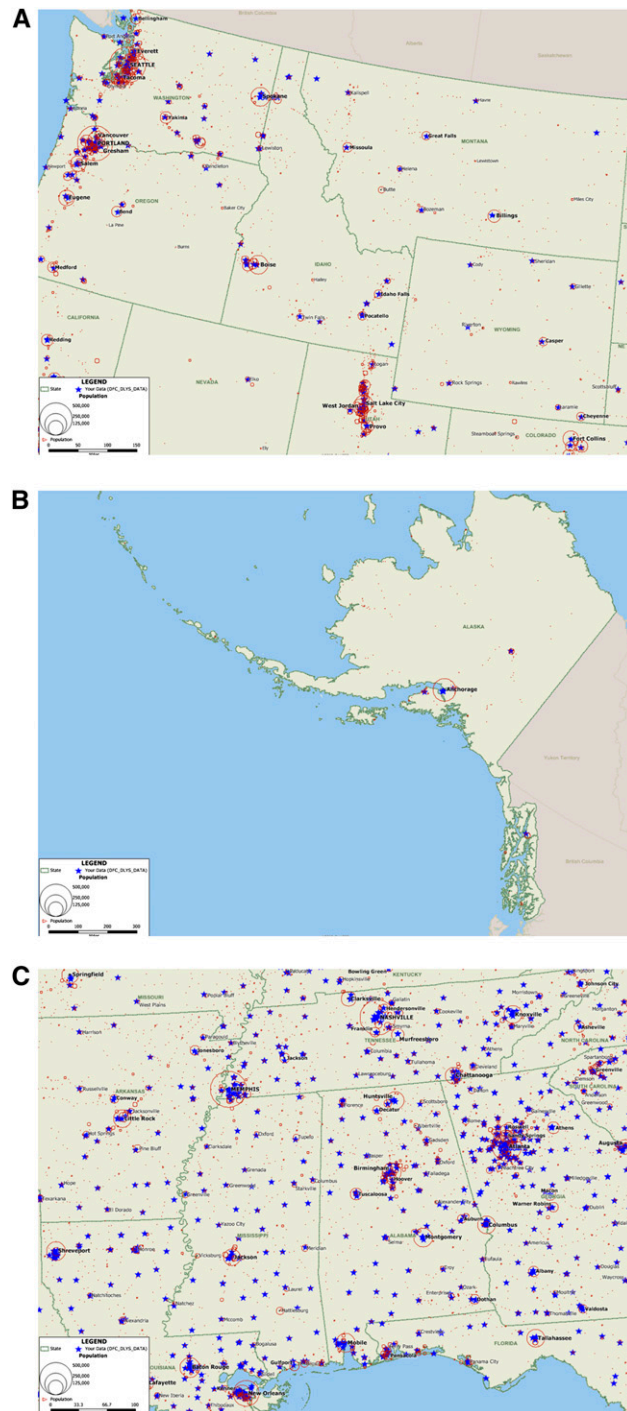


Figure 1. | Dialysis units in the Pacific Northwest, Alaska, and select southern states. Blue stars represent dialysis units, and red circles and dots represent population centers. (Created with Maptitude 2012 by Caliper, using Dialysis Compare and 2010 US Census Data.)

require a multidisciplinary team approach involving local primary care physicians and local medical facilities, which are likely to be unfamiliar with the management of peritoneal dialysis patients and the transplant referral process.

Returning to the case, this gentleman said he would rather die than move from his home located in an idyllic rural area. He accepted the risks of peritoneal dialysis and is currently thriving on the therapy. However, one day he will likely start to fail on peritoneal dialysis and he will be faced with some difficult decisions. From a medical standpoint, he may be best served by relocating closer to a hemodialysis unit, but moving from his community would leave him isolated from his friends and support structure and possibly drive him into poverty. A frank discussion would explore relocation along with other options including optimizing his peritoneal dialysis prescription, providing more peritoneal dialysis support, switching to home hemodialysis, and if appropriate, kidney transplantation. Geography does matter, and the renal community should start adapting to the needs of the rural patients requiring renal replacement therapy.

Disclosures

None.

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